REMARKS

Claims 1-28 are pending and rejected. Claims 1-4, 6-11, 14-18, 20-26, and 28 were rejected as obvious in view of the combination of Champlin et al. U.S. Patent No. 6,172,483 ("Champlin") and Ding et al. U.S. Patent No. 6,094,033 ("Ding").

The invention as set forth in claim 1 is directed to a method for determining the state of charge (SOC) of a battery. In the method, a transition frequency of the complex impedance of the battery is determined. The transition frequency is the frequency at which the battery's impedance crosses the real axis, *i.e.* the frequency at which the imaginary part of the battery's impedance vanishes. The method uses the new finding that there is a clear-cut relationship between the transition frequency and the SOC of the battery. Particularly, the SOC is determined by assigning the measured transition frequency to the battery's SOC.

Champlin describes a method for measuring the complex impedance of batteries. With the method, a time-varying current excites the battery (*see, for example*, col. 1, lines 53-57 and col. 3, lines 12-30). The current and the voltage over the battery are acquired and used for the calculation of the battery's impedance at a certain frequency (*see, for example*, col. 1, line 57 to col. 2, line 7; col. 12, lines 44-54). The calculation employs a Fourier transformation technique for determining Fourier coefficients of the current signal and the voltage signal and the coefficients are used for calculating the real and imaginary part of the impedance (*see, for example*, col. 2, lines 1-7).

Champlin does not teach or suggest determining the transition frequency of the battery's impedance.

The disclosure of Champlin is limited to a method for determining the parameters of the impedance itself. In contrast thereto, the present invention comprises determining the transition frequency of the battery's impedance, which is not a parameter of the impedance itself, but a frequency at which the parameters of the impedance have certain properties.

Moreover, in the method disclosed by Champlin the battery's impedance is evaluated at a predetermined frequency. A determination of frequency having certain characteristics is not suggested.

Furthermore, Champlin does not disclose or suggest that there is a relationship between the transition frequency and the SOC of the battery. Consequently, Champlin fails to teach or suggest assigning the transition frequency to the SOC of the battery.

Ding describes a battery SOC detector, which can be used for controlling the charging of a battery (*cf.* col. 2, lines 54-58). The SOC evaluation is based on the battery's response to an AC current applied to the battery (*cf.* col. 4, lines 48-65). In one embodiment, equivalent circuit parameters of the battery, which are related to the battery's impedance — *i.e.* phase angle, series and parallel capacitance, series and parallel resistance — are determined from the battery's response at various frequencies, and used for determining the SOC of the battery (*cf.* col. 5, lines 6-64). In another embodiment, the electrochemical overvoltage of the battery is determined from the battery's voltage response to a current pulse and associated with the SOC of the battery (*cf.* col. 6, lines 5-22).

In a further embodiment, the battery's internal resistance is determined and associated to the SOC (*cf.* col. 6, lines 23-32). The Office alleges that Ding at col. 6, lines 23-28 teaches assigning the transition frequency to the SOC of the battery; however, this is a misinterpretation of Ding, which at col. 6, lines 23-28 states:

> Preferred embodiments of the SOC detector 10 also can estimate battery SOC based upon the relationship between a battery's internal resistance and SOC. Once the battery's internal resistance has been determined in a conventional manner, an estimated SOC is calculated by referencing an electrochemical overvoltage vs. SOC diagram (i.e. FIG. 2).

See also Fig. 4 of Ding, showing internal (Ohmic) resistance versus SOC for a typical lead-acid battery. Thus, Ding does not teach assigning the transition frequency to the SOC of the battery, but instead relates internal resistance to SOC of the battery.

In view of the impedance of the battery, Ding teaches measuring the impedance or parameters related to the impedance and associating these parameters to the

SOC of the parameter. However, as described above, the transition frequency of the impedance is not a parameter of the impedance itself, but the frequency at which the impedance fulfils certain criteria, particularly, the frequency at which the imaginary part of the impedance vanishes. Ding fails to teach or suggest determining this frequency. Moreover, Ding does not disclose or suggest that there is be a relationship between the transition frequency and the SOC of the battery. Consequently, Ding does not suggest assigning the transition frequency to the SOC of the battery.

For the reasons given above, claim 1 is inventively distinguished over of the applied art. The limitations of claim 14 correspond to the features of claim 1. Therefore, claim 14 is likewise inventively distinguished over the applied art.

CONCLUSION

In the absence of more pertinent prior art, withdrawal of the rejections and allowance of all pending claims are respectfully requested.

Should the examiner wish to discuss the foregoing, or any matter of form or procedure in an effort to advance this application to allowance, the examiner is urged to telephone the undersigned attorney at the indicated number

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Respectfully submitted,

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